(b)

REPORT

ON THE

Partabgarh Agricultural Station

OF THE

UNITED PROVINCES OF AGRA AND OUDH.

FOR THE YEAR ENDING JUNE 30th, 1909.

ALLAHABAD:
PRINTED BY F. LUKER, SUPDT., GOVERNMENT PRESS, UNITED PROVINCES.
1909.

Digitized with financial assistance from

Hemendra Kothari

on 24 February, 2020

No. $\frac{235P}{A-92}$ of 1909.

From

W. H. MORELAND, Esq, C.I.E., I.C.S.,

Director of Land Records and Agriculture,

United Provinces,

To

The CHIEF SECRETARY to GOVERNMENT,

United Provinces.

Dated Partabgarh, the 16th September 1909.

Sir,

I have the honour to submit the report on the Partabgarh Agricultural Station for the year ending 30th June 1909.

The report has been drawn up by the Assistant Director in charge of the Eastern Circle.

I have the honour to be,

Sir,

Your most obedient servant,

W. H. MORELAND,

Director.

Report on the Partabgarh Agricultural Station ending 30th June 1909.

I.—SITUATION, HISTORY AND OBJECTS.

The farm is situated in the villages Karanpur, Lukhá and Sagrá, about one mile and a half west of the Partabgarh Oudh and Rohilkhand Railway station, about one mile from the Belhá town and less than half a mile from the Partabgarh Collectorate. The metalled road from the Collectorate to Katra runs along the eastern boundary of the farm. On the west it extends up to the metalled road running from the civil courts to fort Partabgarh.

The area of the farm is 89·8 acres, of which 65 acres are under cultivation and the rest is occupied by roads, groves, buildings and tanks. The land was acquired in 1906, and in that year the levelling of uneven areas and construction of buildings were taken up, the cultivated area being sown principally with food crops. The farm is meant chiefly for experiments on different varieties of rice, maize, wheat and sugarcane, but at present the cultivation of these and other staples is carried on mainly with a view to determining the suitability of the soil to the various crops and their varieties and the degree of fertility of the various plots which it is intended to devote to actual experiments. Within the farm there is a *jhil* which stretches from south-east to north-west. In the greater portion of the *jhil* water stands throughout the rainy season and in some parts of it till winter, unless utilised for irrigation of the rice crop. The area adjoining the *jhil* is transplanted with late rice. The cultivated land is all irrigable from wells; three of which have been built since the acquisition of the farm and two are old which were originally constructed by the zamindars who owned the land. The farm comprises nearly all classes of land ordinarily met with in the south of Oudh: heavy clay (*matiar*) suitable for rice, light and heavy loams (*dumat*) and the poorer kind known as *bhur*, sandy or interspersed with kankar and bajri (nodulated lime-stone). Samples of soil and sub-soil were analysed by Mr. G. Clarke, the Agricultural Chemist of the Department last year and the results of his analyses are given below :—

Analyses of loam soil and sub-soil No. 1 A. and No. I. B.

	No. 1 A. Loam.	No. 2 A. Loam (sub-soil.)
Insoluble matter, soluble and insoluble silica ...	87·80	85·15
Potash (K_2O)	0·36	0·48
Lime (Cao.)	0·47	0·53
Magnesia (Mgo.)	0·89	1·01
Manganese Oxide (Mno).	...	...
Ferric Oxide (Fe_2O_3)	5 99	7·88
Alumina (Al_2O_3)		
Phosphorus Pentoxide (P_2O_5)	0·20	0·21
Organic matter	3·44	3·47
Combined water	0·64	1·02
Undetermined (soda and traces of chlorine and sulphate)	0·21	0·25
Total ...	100·00	100·00
Total nitrogen ...	·042	·025%

Partial analyses of representative soil samples obtained from the principal cultivated plots at the Partabgarh farm, 1907-08.

No.	Description	P_2O_5 %	K_2O %	N %
48	No. 1 A, No. of field 130-131, dumat (loam). Sample of soil up to the depth of 9″.	0·20	0·36	0·042
49	No. 1 B, No. of field 130-131, dumat (loam). Sample of sub-soil up to the depth of 6″ below 9″.	0·21	0·48	0·025
50	No. 11 A, No. of field 119, clay. Sample of soil up to the depth of 9″.	0·29	0·39	0·056
51	No. 11 B, No. of field 119, clay. Sample of sub-soil up to the depth of 6″ below 9″.	0·31	0·51	0·022

Partial analyses of representative soil samples obtained from the principal cultivated plots at the Partâbgarh farm 1907-08—(concluded).

No.	Description.	P_2O_5 %	K_2O %	N %
52	No. 111 A, No. of field 41, dumat (loam). Sample of soil up to the depth of 9″.	0·22	0·36	0·061
53	No. 111 B, No. of field 41, dumat (loam). Sample of sub-soil up to the depth of 6″ below 9″.	0·25	0·34	0·069
54	No. IVA, No. of field 57 and 58, halki dumat (light Loam). Sample of soil up to the depth of 9″.	0·19	1·78	0·056
55	No. IV B, No. of field 57 and 58, halki dumat (light loam). Sample of sub-soil up to the depth of 6″ below 9″.	0·19	1·31	0·050
56	No. VA, No. of field 247-248, bhur (sandy). Sample of soil up to the depth of 9″.	0·19	0·97	0·039
57	No. V B, No. of field 247-248, bhur (sandy). Sample of sub-soil up to the depth of 6″ below 9″.	0·19	0·76	0·023
58	No. VI A, No. of field 95, bhur (sandy). Sample of soil up to the depth of 9″.	0·17	1·50	0·044
59	No. VI B, No. of field 95, Bhur (sandy). Sample of sub-soil up to the depth of 6″ below 9″.	0·14	1·06	0·019

Complete analyses could be conveniently made only in the case of loam which is the predominating class. In case of other soils the percentages only of phosphoric acid, potash and nitrogen, the chief fertilising constituents, were determined.

II.—CHARACTER OF THE SEASON AND RAINFALL.

The year under report and the one preceding it have been characterised by a very scanty rainfall, the farm having received only 26·45″ and 26·72″ of rain respectively against 39·21″, the average of the previous seven years. The following statement gives details of the rainfall :—

Month.	Average of seven years (1900-01 to 1906-7.	1907-8.	1908-9.
June	1·33	0·67	1·76
July	12·55	8·17	8·88
August... ...	12·72	16·67	7·34
September ...	7·55	0·00	3·78
October... ...	2·39	0·00	0·32
November ...	0·06	0·00	0·00
December ...	0·18	0·00	0·00
January ...	0·58	0·71	0·42
February ...	0·19	0·38	0·17
March	0·26	0·00	0·00
April	0·11	0·09	3·78
May	0·38	0·03	0·00
	39·21	26·72	26·45

During the year under report the monsoon broke in good time, the first fall having been received on the 30th of June. In July and August the total rain received was considerably below normal, while the long break extending from 7th to 29th August caused no small damage to the standing *kharif* crops. The rain in September was again scanty while the winter months were practically rainless ; the few light showers received being of no real value. The late rice was generally damaged by early cessation of the monsoon, and the absence of moisture in the ground was a disadvantage for the rabi. The rain received in April damaged the grain on the threshing floor quite appreciably but proved highly beneficial to the sugarcane and facilitated the preparation of land for the ensuing *kharif*. The grain affected by the rain at the threshing time had to be sold in the bazar, an unfortunate loss to the seed dépôt, which receives its best supply of acclimatised rabi seeds from the farm.

III.—KHARIF EXPERIMENTS.

(a) Cultivation of rice.

Five varieties of transplanted rice (jarhan) were tried at the farm. Two of them, viz., Bánsmati and Hansráj were imported from Pilibhit and the remaining three procured locally. The agricultural operations were alike in all cases. The fields were ploughed twice and levelled once. The seedlings raised previously in nurseries were transplanted during the 1st week of August. No manure of any sort was applied to the fields. Owing to early cessation of rains, the crop suffered a great deal and had to be watered oftener than usual. The little water that was in the tank was all used up in the first watering and for the last three waterings well-irrigation had to be resorted to. The crop was, however, not attacked by disease or insects. A statement showing the outturn of all the five varieties is given below :—

Statement showing the outturn of different varieties of late rice grown at the Partabgarh farm.

Number.	Name of crop.	Area under each crop.	Outturn of each crop.	Outturn per acre.	Remarks.
		Acres.	lbs.	lbs.	
1	Shamghata (Sultanpur)...	·27	664	2,459·26	
2	Jogia (Sultanpur) ...	·30	703	2,343·30	
3	Bánsmati (Pilibhit) ...	·23	461	2,004·35	
4	Hansráj (Pilibhit) ...	·44	474	1,077·27	
5	Sambhalu (Sultanpur) ...	·41	461	1,124·39	

The first two kinds in the table above are usually highly prolific, but take longer to mature and consequently require more waterings. Nos. 3 and 4 are the best of the finer classes of rice grown in Pilibhit, and ripen early, hence they are ready for the attacks of flies, at a time when the later kinds are still in the flowering stage, and consequently not attractive to those pests. Both of these submontane kinds are proving themselves to be suitable to the conditions of Partabgarh, but more detailed experiments are necessary for determining their comparative outturns. Sambhalu is the earliest of the finer kinds under trial and has given a fair outturn in spite of the unfavourable weather conditions.

Two local varieties of broadcast rice, viz., Banki and Mutmuri were also tried. The outturn is given in the statement below. The crop was considerably damaged by want of rain and the outturn was very poor in consequence.

Statement showing the outturn of different varieties of early rice grown at the Partabgarh farm.

Number.	Name of crop.	Area under each crop.	Outturn of each crop.	Outturn per acre.	Remarks.
		Acres.	lbs.	lbs.	
1	Banki ...	1·75	1,205	745·71	
2	Mutmuri ...	2·25	1,613	716·89	

(b) Introduction of maize in the locality.

Cultivators in the neighbourhood of the farm believed that they could not successfully grow maize owing to the liability of the crop in particular to the attacks of wild birds and animals. To shake off their belief several varieties of maize were imported from Jaunpur, Ballia, Bareilly, Gonda, Meerut and Cawnpore districts. During the first two years' trials it was found that the Jaunpur maize was best suited to the locality. The plot meant for this variety during the year, which was the richest that could be conveniently allotted to the crop, was ploughed once with improved plough and once with country plough, being manured in between with sweepings of the town. Seeds were dibbled before rains in holes 1 foot apart, in rows 1½ foot distant from each other, each hole receiving from 3 to 4 seeds. The seed thus sown amounted to 12 lbs. per acre. When the crop

was 7 to 8 days old the thin and sickly plants were weeded out and only the strongest were allowed to remain in the holes. The crop grew very luxuriantly and was in the most flourishing condition throughout the season. It was, however, damaged to a certain extent by wild boars, jackals, etc., for which special watch had to be kept. With a view to showing the success of this trial a meeting of cultivators was held at the farm just before the harvest. The operations were explained to them and the method of cultivation was highly appreciated. The cultivators were convinced of the advantages of deep tillage and the system of dibbling. As a result of this demonstration some of the cultivators in the neighbourhood have grown some maize this year which may be considered as the first step towards introduction of the staple.

Varieties other than Jaunpur were sown after rains under similar conditions with no manure at all, the method of cultivation being alike in all cases. The subjoined table gives the acreage outturn:—

Statement showing the outturn of varieties of maize procured from different districts.

No.	Name of crop.	Area under each crop.	Outturn of each crop.	Outturn per acre.	Remarks.
		Acres.	lbs.	lbs.	
1	Jaunpur Maize ...	·5	1,782	3,564	Manured.
2	Chalánká of Meerut ...	·125	123	984	Unmanured.
3	Air of Meerut ...	·125	72	576	
4	Red Maize of Gonda ...	·125	137	1,096	
5	Jogia of Gonda ...	·125	170	1,360	
6	Dudhia of Gonda ...	·125	112	896	
7	Ballia Maize (yellow) ...	·5	578	1,156	
8	Bareilly maize (white) ...	·5	338	676	

These trials are preliminary only and intended to show the relative suitability of different varieties to the locality: more rigorous conditions of experiment are required for actual quantitative tests.

(*c*) *Cultivation of jute.*

Jute, the famous fibre-crop of Bengal, is not cultivated in these Provinces and is practically unknown to the cultivator.

Two varieties of it, *viz.*, (1) *Capsularis* and (2) *Olitorius* were introduced into the farm, experimentally. The method of cultivation followed was similar to that adopted in the case of Sanai (Crotolaria Juncea), the most important fibre crop of South Oudh. The stalks were cut in the middle of September and rotted in the same manner as for Sanai. The fibre produced was sent to Mr. R. S. Finlow, Fibre Expert to the Government of Eastern Bengal and Assam, for opinion, which he expressed in the following terms:—

"The sample labelled olitorius is slightly over-retted in the upper portion but it is well cleaned and free from root. The length is fair and colour and gloss good. It is worth about Rs. 7 per maund at the present time. The sample labelled capsularis though well rotted is coarser than the other one. It is free from root and its length is fair but its colour is not quite so good the latter probably being due to rather dirty rotting water. Its value is about Rs. 6 to Rs. 6-8 per maund. Both samples, though perhaps rather shorter than average Bengal jute, are, on the whole quite equal as regards quality to the fibre which usually comes into the Calcutta market." Subsequently Mr. Finlow intimated that the price of jute in the Calcutta market had declined and that the Partabgarh samples were at that time worth Rs. 5 to Rs. 5-8 per maund.

Capsularis yielded 714 lbs. and olitorius 697 lbs. of fibre per acre. Assuming the average outturn of jute fibre to be $8\frac{1}{2}$ maunds, worth at least Rs. 42-8, and the normal yield of Sanai to be $7\frac{1}{2}$ maunds per acre, worth only Rs. 30, the experience of the first year gives hopes of a promising future for jute. But it would be premature to pronounce any definite opinion pending comparative trials.

(*d*) *San hemp from Central Provinces.*

The Deputy Director of Agriculture, Central Provinces, spoke very highly in one of his notes published in the Agricultural Journal of India, of the profitable cultivation of San hemp grown in his Provinces. Some seed of this kind grown there was obtained from him and sown at the farm. The seed was received very

late, so that it could not be put into the ground before the 17th of July. The crop yielded 544 lbs. of fibre and 812 lbs. of seed per acre, which is somewhat below the normal yield of the local crop, but possibly the late sowing may account for the defect. The trial is being repeated.

(e) Sugarcane.

The sugarcane grown at the farm comprised nearly all the varieties of South Oudh and Eastern districts which are specially famous for their sugar-yielding qualities. Of these varieties Sarauti and Kuswar were locally procured while the rest were raised from seed originally imported from outside and acclimatised at the farm.

Method of cultivation.—The cane crop followed the autumn pulses, urd (phaseolus radiatus) and guar (cyamopsis psaralioides). After the harvesting of these crops the land was irrigated with well water in order to soften the soil which was then ploughed and cross-ploughed thrice with Watt's plough. Five ploughings with the country plough were then given, each ploughing being followed by levelling the fields with the *patela* (flat wooden beam). No manure of any kind was used before or after planting. When the seed bed was ready to receive the seed, cuttings of the whole cane, each about 18 inches in length, were planted in March 1908, in the usual manner behind the plough and the land levelled. The crop was watered five times during the period of growth, each watering being followed by one hoeing. The harvesting of the crop was commenced in the month of January. The Agricultural Chemist formulated a definite scheme for experiments with one variety of cane, *viz.*, Reora of Benares, and for this purpose 11 plots, one-tenth of an acre each, were set apart. The number of cuttings planted in eight of these plots ranged from 3,000 to 10,000 and in the remaining three plots from 12,000 to 18,000. These plots were sown under Mr. Clarke's personal supervision but unfortunately the germination was very bad as the seed had been seriously damaged in transit. The plots had to be resown with his approval with another variety, the Kuswar of Partabgarh, by the usual method. When the crop was being harvested, Mr. Clarke conducted a long series of tests for determination of sugar. The results of his investigations will, it is expected, form subject of a separate note, like last year. The statement given below gives the outturn of the different varieties of cane grown at the farm:—

Statement showing the outturn of different varieties of sugarcane grown at the Partabgarh Experimental Station, season 1908-9.

Serial No.	Name of each crop.	Area under each crop.	Outturn of gur from each field.	Outturn of gur per acre.	Remarks.
		Acres.	lbs.	lbs.	
1	Kuswar of Amethi ...	1·1	5,113·75	4648·86	
2	Reora of Benares ...	·10	490	4900·	
3	Reori of Benares ...	·25	1,191	4764·	
4	Kewahi of Benares ...	·09	322	3577·77	
5	Hemja of Gorakhpur,	·13	402	3092·3	
6	Reora of Gorakhpur,	·16	595	3718·75	
7	Charkhai of Azamgarh,	·19	578·25	3043·24	
8	Dhoura of Azamgarh,	·185	813·75	4395·95	
9	Pansari of Yusufpur (Ghazipur).	·31	832·25	2684·68	
10	Mumcha of Basti ...	·077	310·5	4032·48	
11	Sarouti of Basti ...	·13	352	2707·69	
12	Mutki mango of Shahganj (Jaunpur.)	·25	390	1560·	This plot was greatly damaged by white-ants in the germination stage.
13	Patarki mango of Shahganj (Jaunpur.)	·25	587	2346·	This was also damaged to some extent by white-ants.
14	Kuswar of Partabgarh (Ratoon).	·18	537	2983·33	Sulphate of ammonia was applied in 1st year (1907-8).
15	Kuswar of Partabgarh (Ratoon).	·183	443	2420·77	No manure.
16	Sarouti of Partabgarh (Ratoon).	·5	790	1580·	Very stunted growth.

Field No. 1 in the statement comprises the 11 plots belonging to Mr. Clarke's experiment just mentioned. Fields Nos. 14 and 15 deserve special notice. In 1907-8, the former was manured with ammonium sulphate at 5 cwt. per acre while the latter remained unmanured, other treatments being similar. The growth of the crop in the manured plot was highly luxuriant which delayed the ripening. It was harvested at the same time as the mature crop of the unmanured plot. The yield of *gur* per acre from the manured plot was 1,067 lbs. lower and contained only 10·81 percentage of sucrose against 13·00 percentage contained in the *gur* obtained from the unmanured plot. Thus the effects of the artificial manure though very striking on the growth were far from beneficial on the quality of the outturn which was no doubt partly due to the immature condition in which the ammonium sulphate plot was harvested, along with the other plots.

During the year under report it was decided to watch the effect of the ammonia residue on the ratoon crop. The roots in both plots were therefore left in the ground and allowed to grow again. In June 1908 the two plots were irrigated once and hoed with the *kudali*. No other field operations were carried out during the remaining period of growth. The harvesting commenced on the 15th of January 1909, when both the crops appeared to have approached maturity. The outturn of *gur* in the ammonium sulphate plot was 562·56 lbs. higher than in the unmanured plot. The quality did not appear to be in any way inferior to the other and the *gur* fetched Rs. 5-8-0 per maund in the local market. Possibly the 5 cwt. dose of ammonium sulphate was too large to start with for the land in high conditions of natural fertility we are dealing with, and a smaller application might prove more useful, but it is apparent that the stimulating effects of the chemical in the first year and the residual effects in the second were quite marked and it is desirable therefore to continue the trials. It may be observed that the outturn of the unmanured plot in the present case was quite up to the recognised average outturn for the south of Oudh. This however is accounted for by the efficient tillage carried out in the first year.

The average outturn at the farm during the year amounted to 42 maunds of *gur* per acre worth Rs. 210. The cost of cultivation and manufacture including labour calculated at the current rates does not exceed Rs. 110, leaving a net profit of Rs. 100 per acre. The financial results were discussed with neighbouring cultivators, who have in consequence quite appreciably extended sugarcane cultivation in the farm neighbourhood.

A small area was planted with the more prominent varieties of *paunda* imported from Lucknow and from the agricultural station at Samalkota in Madras for propagation of seed.

Several varieties of Mauritius canes received from the managing agents, Cawnpore Sugar Works, were also sown in order to obtain seed canes for next sowings. All these attracted considerable attention on the part of distinguished visitors.

The efforts have been so far confined to propagation of seed, enough to meet the demand for *paunda* seed canes which is slowly rising. During the year seed canes of the more promising varieties were supplied to five constituents residing in Benares, Partabgarh, Rae Bareli and Sultanpur and have been planted by them.

I brought seed canes of five varities from Dumraon Farm in 1907, and planted them for raising seed canes.

Of these one *sonabeli*, a thick variety, is the most promising.

IV.—RABI CROPS.

The area of the farm at present is not sufficient for any extensive programme of rabi experiments. The fields suitable for rabi crops, though not scarce, seem to differ very widely from each other in respect of natural fertility and are scattered, the few compact blocks, suited for that class of operations, are conspicuously wanting in uniformity of composition besides being uneven, and much labour has had to be spent on levelling them. Thus, while it has been possible after two years of close observation to allot plots of fairly uniform texture and fertility to sugarcane, rice and maize, the existing circumstances did not admit of similar plots being decided on for any regular experiments on rabi staples and no agricultural experiment, in the strict sense of the term, has hitherto been taken in hand in that direction.

Opportunity has, however, not been lost of turning to good account the rabi fields that were available by growing in them from carefully selected seed, the staples required for distribution from the Provincial Seed Dépôt which is engaged in the useful but laborious work of improving the seed stock of the district. For this purpose the typical white soft wheat was originally imported from Muzaffarnagar, Cape oats from Meerut, white linseed from Nagpur, pale gram from Bhatinda, white Kabuli gram from Cawnpore, while barley, peas, dark gram and brown linseed were procured locally.

The best seeds were selected from the first lot and grown with deep tillage and timely artificial waterings, but in most cases with no manure. As a result of careful cultivation the growth of the crops was remarkably luxuriant in general which elicited the most flattering remarks from the neighbouring cultivators and the outside visitors. At the harvest the best ears or pods were picked out and threshed separately for preservation of the seed.

In the next sowing season the preserved seed was again subjected to a more careful process of selection by separating with *sup* (the indigenous hand separator) and sieves the thinner seed from the plump and the latter alone utilised for sowing. The rest of the produce was passed on to the seed dépôt for the use of its constitutents. In this way the farm, though not carrying out any definitely organised variety or manurial experiments in the rabi season, has been growing, on one hand, selected seed with the object of eventually establishing "Pedigree" varieties, and, on the other, contributing better seed to the stock intended for the benefit of the local cultivators.

When uniform blocks are available at the farm, these selected seed trials will be started on a more systematic footing. The efforts during the last two years have been devoted principally to determination of the uniformity of the blocks which are *prima facie* suitable.

The following remarks are offered to indicate the lines on which this class of work has been done during the year under report. One block of nearly one and four-fifths of an acre was chosen and prepared for wheat in the usual manner.

It was then sown with selected seed. At the harvest the block was divided into nine parts of equal size: the measurements being made with a measuring tape with the utmost care and pegs being driven in at the boundary points. Before these plots were actually reaped cords were stretched between the pegs to ensure the accuracy of the areas. The sheaves from each plot were separately stocked and threshed and the grain winnowed out separately. Another block of one acre was treated similarly and divided into five plots, each 969 square yards in area, the produce being also handled in like manner. The results of the various determinations are embodied in the subjoined table :—

Statement showing the outturn of wheat plots tested for their uniformity of produce.

No. of block.	No. of plot.	Name of crop.	Area of each plot.	Outturn of each plot in lbs.	Outturn per acre.	Remarks.
				lbs.	lbs.	
Block No. I consisting of khasra Nos. 40, 41, and 42 and part of khasra No. 90.	1	Muzaffarnagar wheat	965 Sq. yards.	261	1,309	
	2	Ditto ...		322	1,615	
	3	Ditto ...		357	1,790	
	4	Ditto ...	„	370	1,855	
	5	Ditto ...	„	396	1,986	
	6	Ditto ...	„	386	1,936	
	7	Ditto ..	„	428	2,146	
	8	Ditto ...	„	445	2,231	
	9	Ditto ...	„	492	2,462	
Block No. II consisting of khasra Nos. 38 and 39, and part of khasra No. 90.	1	Ditto ...	969 Sq. yards.	265	1,323	
	2	Ditto ...	„	258	1,285	
	3	Ditto ...	„	350	1,748	
	4	Ditto ...	„	370	1,848	
	5	Ditto ...	„	336	1,678	

It will be seen that the variations are still so great as to show that it will be unwise to devote the plots to experiments of any scientific value. Continuation of cropping alone, without manure, can bring about the desired degree of uniformity. As to the outturns, it may be observed that the highest has amounted to 2,462·64lbs. (block no. I plot no. 9) or nearly 30 maunds an acre which is about double the average wheat outturn of Oudh. The lowest outturn comes to 1,285·57 lbs. (block no. II plot no. 2) or 15·64 maunds which is slightly above the average. The average outturn of (block no. 1) is 1814·8 lbs. or 22 maunds per acre or more than 50 per cent. above the average, and that of (block no. II) is 1,576·7 lbs. or 19·18 maunds or nearly 27 per cent. above the normal.

A very interesting example may be quoted of a plot of land adjacent to the *jhil* which receives a deposit of silt every year during the rainy season and is suitable specially for barley. The outturn of barley from this plot amounted to 59 maunds in the past year and 50 maunds per acre during the year under report.

Other noteworthy outturns are as follows :—

	lbs.	mds.	
Wheat (plot under Mr. Leake's observation) ...	2,580 or	31·3	per acre
Pale gram (in the *jhil*)	3,064 or	37·2	„
White Kabuli gram	1,154 or	14·0	„
Peas (after rice)	2,742 or	33·3	„
Oats (in the *jhil*)	3,857 or	46·9	„

The discussions of outturns at this length may seem uncalled for but they are important from the standpoint of the practical agriculturist whose sole object is to get the utmost out of the land.

The unusually high outturns quoted which form the most pleasing feature of the results of the labour of the farm staff must be accounted for. My own conviction in the matter is that they are due entirely to the deep tillage resorted to, the fine tilth acquired, the superior seed sown, the timely waterings given, and the general care bestowed upon the crops throughout the period of growth. Moreover, they inspire the belief that there is an extensive scope for improvement of agriculture in the south of Oudh by the simple methods enumerated above to which alone one can attribute the satisfactory figures of outturn that have been obtained.

V.—RECLAMATION OF USAR LAND BY THE USE OF GYPSUM.

In 1907 it was decided to find a typical usar area representative of the class of unculturable land commonly met with in the south of Oudh and try to reclaim it for the purposes of cultivation by applying gypsum in a quantity sufficient to convert the sodium carbonate which is the direct cause of the barrenness into sodium sulphate which is not injurious to plant life to the same extent. A block of usar in village Sarwanpur adjoining the Oudh and Rohilkhand Railway station at Amethi, and a plot at Kusaha about 2 miles north of the station were obtained for the experiment and a truck load of soft gypsum was procured from Khewra in the Punjab, which was broken by means of iron hammers and ground. The total area of the Sarwanpur plots is $5\frac{1}{2}$ acres.

This land has been taken from the Raja of Amethi on a 12 years' lease free of rent on the condition that at the end of that period it will be returned to the Raja in the condition in which it may be at the time without the department claiming any compensation for improvements. There is no lease for the Kusaha plot which is situated in the Raja's rice farm in the Ramnagar jungle.

At Sarwanpur, the main plot measures 1 acre. The surface soil 1 foot deep contained ·197 per cent. of sodium carbonate (Na_2 Co_3) according to Dr. Leather's analysis. The weight of soil 1 foot deep was found to be 4,475,790 lbs. per acre. The soft gypsum obtained from Khewra (North-Western Railway) was found to be of 94·31 purity. The calculated quantity of this gypsum required to neutralise the total sodium carbonate present in the top layer of 1 foot came to 184·556 maunds.

Therefore 185 maunds of gypsum was applied to the one acre plot in two doses, the 1st dose of 100 maunds having been employed in the rains of 1907 and the balance 85 maunds in 1908. Operations had to be stopped in 1907 owing to early cessation of rains which interfered with the progress of ploughing and were resumed at the advent of the monsoon rains in 1908.

An improvement in the natural vegetation was noticeable in the very first year. The cost of gypsum delivered and ground at Amethi so as to be ready for application amounted to Re. 0-14-6 per maund or over Rs. 167 per acre. From an economical point of view therefore it is prohibitive and no landholder would be willing to undergo this high expense even if gypsum proved a complete cure for the usar. There is no chance in consequence of the treatment being adopted as an economical agricultural improvement unless the hope of getting gypsum at considerably cheaper rates can be realised. But the experiment has a scientific value attached to it quite apart from the question of expense and it would be a satisfaction to find a curative agent in gypsum (if it proves so) capable of removing a defect which has, from time immemorial been paralysing the successive efforts of the agriculturists of India towards reclamation.

The cost of the gypsum is due mainly to the distance from the point of supply. It is not impossible that gypsum may be discovered in adequate quantities in some part of Central India whence it can be supplied economically.

Wheat seed was sown in very small trial patches in the plot treated with gypsum (plot No. 1). In some of the patches ordinary farmyard manure was applied and in others no manure was used. Artificial irrigation was freely resorted to during the period of growth. The germination was very good and the plants looked remarkably healthy and vigorous throughout. When the crop was ready, the plants were cut and carefully threshed. The outturns of both manured and unmanured plots were found to be much above the average. No accurate idea of the outturn can, however, be given as the patches were very small and some of the plants had to be sent out to officers of the department as samples, for inspection. With these encouraging indications, it has been determined to sow the whole of the plot with wheat in the ensuing rabi season.

The next point to determine is whether with reference to the high cost of the material, it would be profitable to apply gypsum for the purpose of growing trees. This point is being determined in plot No. 3 at Sarwanpur, area 623 sq. yds. Samples 4 feet deep soil taken from this plot contain ·26 to ·37 per cent. of sodium carbonate (Na_2 Co_3) according to Mr. Clarke's determinations showing that the soil lower down is more highly charged with the alkali than the top layer of 1 foot containing only ·197 per cent. of sodium carbonate.

In plot No. 3, holes were dug for planting trees. Where the *kankar* bed was found within 4 ft. the *thalas* were dug only 4 feet deep; where however the *kankar* bed occurred lower down they were dug six feet deep to break through the *kankar* bed. No kankar was found below six feet. As the percentage of the alkali varies in different parts of the plot, the quantity of gypsum required to neutralise the maximum sodium carbonate, *viz.*, ·37 per cent. was applied to each hole. For holes 4 feet deep the weight of gypsum used was 13 seers and for holes 6 feet deep it was 19½ seers. The kankar bed was broken in each case but the *kankar* was not thrown away. It was mixed with the earth and gypsum and returned to the holes. At the top of each hole thus refilled a layer of 1½ to 2 feet of good earth was placed so as to give the young plants a fair start, while the chemical change was going on underneath. Mahua (Bassin Latifolia) and Shisham (Dalbergia Sissu) were planted in October. The condition of the trees on the whole is fair. Very few died out and they have been replaced by fresh seedlings.

The cost of gypsum in the case 4 feet *thalas* is about 5 annas and in the other case about 7 annas which are not prohibitive figures, considering the class of valuable timber trees which we are endeavouring to grow.

There are two more plots at Sarwanpur Nos. 2 and 4,—areas 7,392 sq. yards and 5,765 sq. yards respectively. The treatment of these plots does not call for special mention just at present.

The plot in Kusaha is a very small one, only 330 sq. yards, but it is of the worst type and has never grown a blade of grass. Gypsum was applied to this plot at 200 maunds per acre. The plot was sown with wheat in 1908, the germination was good but the plants died out as there was no means of irrigation at hand. A Kachcha well dug near the plot failed to give water.

VI. UTILISATION OF THE RAVINES NEAR THE RIVER SAI.

An area of 4·16 acres of ravine land, liable to erosion from the natural flow of the drainage water during the rains, was leased out in 1907 from the Raja of

Partabgarh and one of his co-sharers in the village Ranjitpur Chilbila, about 2 furlongs east of the Chilbila junction (Oudh and Rohilkhand Railway). An experiment was started in the same year in order to improve the land by making *bunds* at suitable places within the area thus diverting the course of the drainage water in different directions with a view to preventing undue erosion in the embanked plots and allowing the rain water to stand in the plots so as to favour the deposit of silt held in suspension and thus to gradually level up the plots. At the commencement of the rains in July 1907, the land was ploughed deep and divided into compartments of convenient sizes capable of retaining the rain water and embankments of convenient dimensions varying from 1 to 2 feet in height and about the same in width, were raised round them in order to prevent the flow of water from the adjoining area directly into the compartments. In each compartment some bricks were sunk in the ground in absolute level with the surface soil towards the end of the slope so that it may be possible to determine with accuracy from time to time the depth of the successive deposits of silt and bamboo sticks were driven into the ground in order to identify at any time the position of the bricks. In the first year there were frequent breaches in the *bunds*, which were patched up with mud taken from the adjoining areas.

In the succeeding year the breaches were less frequent. In 1907, and again in 1908, bajra, juar and arhar were sown in the kharif, but with a sandy soil and a season of peculiarly scanty rainfall in both years, the results could only be unsatisfactory. From the determination made recently it has been found that the deposits of silt vary from 2 to 6 inches in thickness, in different parts of the embanked plots.

As a result of this demonstration the cultivators in the neighbourhood are beginning to adopt the practice—a practical proof of their appreciation.

PARTABGARH;
The 2nd July 1909.

S. M. HADI, KHAN BAHADUR, M.R.A.C., M.R.A.S.,
Assistant Director of Land Records and Agriculture,
United Provinces.

Digitized with financial assistance from
Hemendra Kothari
on 24 February, 2020